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APPLICATION FOR LETTERS PATENT

TITLE: INFORMATION TRANSMITTING APPARATUS AND
METHOD, INFORMATION RECEIVING APPARATUS
AND METHOD, PROVIDER, AND BROADCASTING
SYSTEM

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**INFORMATION TRANSMITTING APPARATUS AND METHOD, INFORMATION
RECEIVING APPARATUS AND METHOD, PROVIDER, AND BROADCASTING
SYSTEM**

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an information transmitting apparatus and method, an information receiving apparatus and method, a provider, and a broadcasting system. In particular, the invention relates to an information transmitting apparatus and method, an information receiving apparatus and method, a provider, and a broadcasting system in which the transmission amount of data of program information can be increased when the transmission amounts of video data and audio data can be decreased. The invention also relates to an information transmitting apparatus and method, an information receiving apparatus and method, a provider, and a broadcasting system in which the information receiving apparatus can recognize, in a short time, the transmission statuses of schedule EPG data that indicate program broadcast schedules of the transmission side.

2. Description of the Related Art

In digital broadcasting systems, EPG (electronic program guide) data for providing program information is formed in an EIT (event information table) format according to the

rules of DVB/SI (Digital Video Broadcasting/Service Information: EN300468) and multiplexed with other services information (SI) into a transport stream.

Fig. 1 is a table showing an example of the EIT in which the total transmission rate of EPG information is set at 150 kbps. The EIT consists of a network ID, a TS-ID, a service ID, table IDs, program broadcast hours corresponding to the table IDs, program lengths corresponding to the table IDs, and other data. Further, a program title, genre information, etc. can be described in descriptors together with a broadcast start hour and a program length.

The EIT generally consists of EPG data of the self station and EPG data of other stations, each of which consists of data of current and next programs, data of programs within 6 hours from the present time, data of programs that are 6-24 hours away, data of programs that are 2-3 days away, and data of programs that are 4-8 days away. The data of programs within 6 hours from the present time, the data of programs that are 6-24 hours away, the data of programs that are 2-3 days away, and the data of programs that are 4-8 days away are generically called schedule EPG data that indicates a program broadcast schedule. Each of those EPG data has its own Table_id (Table_identification code) and a re-transmission cycle. EPG data are transmitted at re-transmission cycles that are set for the respective Table_id data and have respective prescribed

transmission rates. The EPG data of current and next programs has a relatively short re-transmission cycle of about several seconds. On the other hand, the schedule EPG data indicating a program broadcast schedule has a re-transmission cycle of about several minutes, which is longer than the re-transmission cycle of the EPG data of current and next programs.

As shown in Fig. 2, as for the transmission of EPG data, a prescribed EPG data (including prescribed services information) occupation bandwidth is set for the transmission channel bandwidth of a digital broadcasting system. Since priority is given to the transmission of video data and audio data, the EPG data occupation bandwidth does not vary even if a free portion occurs in the occupation bandwidth for the transmission of video data or the occupation bandwidth for the transmission of audio data.

A viewer takes long time to acquire program information when the data amount of EPG data is large, because EPG data is transmitted to an information receiving apparatus at a constant transmission rate even if a free portion occurs in the occupation bandwidths for the transmission of video data and audio data.

Further, since schedule EPG data indicating program broadcast schedules has long re-transmission cycles and there is no data indicating their transmission statuses, an information receiving apparatus takes long time to judge the

state of the transmission side when the transmission of the schedule EPG data is suspended due to the equipment trouble on the transmission side.

SUMMARY OF THE INVENTION

The present invention has been made in view of the above circumstances, and an object of the invention is therefore to enable acquisition of program information in a short time by increasing the transmission amount of data of program information when the transmission amounts of video data and audio data can be decreased.

Another object of the invention is to allow an information receiving apparatus to recognize, in a short time, the transmission statuses of schedule EPG data that indicate program broadcast schedules of the transmission side.

An information transmitting apparatus according to the invention comprises multiplexing means for multiplexing a plurality of signals; and control means for controlling a multiplexing ratio among the plurality of signals in the multiplexing means.

An information transmitting method according to the invention comprises a multiplexing step of multiplexing a plurality of signals; and a control step of controlling a multiplexing ratio among the plurality of signals in the multiplexing step.

A provider according to the invention provides a computer-readable program for causing an information transmitting apparatus to execute a process comprising: a multiplexing step of multiplexing a plurality of signals; and a control step of controlling a multiplexing ratio among the plurality of signals in the multiplexing step.

An information receiving apparatus according to the invention comprises separating means for separating program information that is multiplexed with a video signal and an audio signal; storing means for storing the program information separated by the separating means; and control means for controlling operations of the separating means and the storing means in accordance with a transmission rate of the program information.

An information receiving method according to the invention comprises a separating step of separating program information that is multiplexed with a video signal and an audio signal; a storing step of storing the program information separated by the separating means; and a control step of controlling operations of the separating step and the storing step in accordance with a transmission rate of the program information.

A provider according to another aspect of the invention provides a computer-readable program for causing an information receiving apparatus to execute a process comprising a

separating step of separating program information that is multiplexed with a video signal and an audio signal; a storing step of storing the program information separated by the separating means; and a control step of controlling operations of the separating step and the storing step in accordance with a transmission rate of the program information.

A broadcasting system according to the invention is such that an information transmitting apparatus comprises video encoding means for encoding a video signal; audio encoding means for encoding an audio signal; program information data generating means for generating data of program information; multiplexing means for multiplexing the data of the program information that is output from the program information data generating means with video data that is output from the video encoding means and audio data that is output from the audio encoding means; and control means for controlling a data output rate of the video encoding means, a data output rate of the audio encoding means, a data output rate of the program information data generating means, and a multiplexing ratio among the video data, the audio data, and the data of the program information in the multiplexing means, and that an information receiving apparatus comprises separating means for separating the program information that is multiplexed with the video signal and the audio signal; storing means for storing the program information separated by the separating means; and control means for

controlling operations of the separating means and the storing means in accordance with a transmission rate of the program information.

An information transmitting apparatus according to another aspect of the invention comprises program information data generating means for generating program information data including information of a transmission status of program information; and multiplexing means for multiplexing the program information data generated by the program information data generating means with an encoded video signal and an encoded audio signal.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a table showing an example of EIT;

Fig. 2 shows how a video data occupation bandwidth, an audio data occupation bandwidth, and an EPG data occupation bandwidth vary with time in relation to a transmission channel bandwidth;

Fig. 3 is a block diagram showing the configuration of an information transmitting apparatus according to an embodiment of the present invention;

Fig. 4 is a table showing an EIT in which the total transmission rate of EPG information is set at 330 kbps;

Fig. 5 shows how a video data occupation bandwidth, an audio data occupation bandwidth, and an EPG data occupation

bandwidth vary with time in relation to a transmission channel bandwidth in a case where the transmission rate of EPG data is increased at prescribed time points;

Fig. 6 is a flowchart showing a bandwidth allocation changing process of a system controller;

Fig. 7 is a block diagram showing the configuration of an information receiving apparatus according to an embodiment of the invention;

Fig. 8 is a flowchart showing the operation of an EPG data acquisition process of the information receiving apparatus;

Fig. 9 shows an EIT form that defines a description format of EPG data of current and next programs;

Fig. 10 shows a description of the transmission statuses of schedule EPG data that is made in a descriptor of EPG data of current and next programs and indicates program broadcast schedules;

Fig. 11 is a flowchart showing a process of the information transmitting apparatus for acquiring data of the transmission statuses of schedule EPG data indicating program broadcast schedules; and

Fig. 12 shows a form of a table information table that defines an SI description format.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 3 is a block diagram showing the configuration of an information transmitting apparatus according to an embodiment of the invention. The information processing apparatus 1 outputs a transport stream TS based on a plurality of video signals and audio signals that are input externally. An MPEG video encoder 11-1 generates a video elementary stream based on a video signal that is input externally and outputs it to a multiplexer 13-1. An MPEG video encoder 11-2 generates a video elementary stream based on a video signal that is input externally and outputs it to a multiplexer 13-2.

An MPEG audio encoder 12-1 generates an audio elementary stream based on an audio signal that is input externally and outputs it to the multiplexer 13-1. An MPEG audio encoder 12-2 generates an audio elementary stream based on an audio signal that is input externally and outputs it to the multiplexer 13-2.

The multiplexer 13-1 multiplexes a video elementary stream supplied from the MPEG video encoder 11-1 and an audio elementary stream supplied from the MPEG audio encoder 12-1 by incorporating those into packets having a prescribed fixed length, and outputs the packets to a transport stream multiplexer 14. The multiplexer 13-2 multiplexes a video elementary stream supplied from the MPEG video encoder 11-2 and

an audio elementary stream supplied from the MPEG audio encoder 12-2 by incorporating those into packets having a prescribed fixed length, and outputs the packets to the transport stream multiplexer 14.

An SI database 15 supplies system information data stored therein to an SI/EPG data generator 17. An EPG database 16 supplies EPG data stored therein to the SI/EPG data generator 17. The SI/EPG data generator 17 incorporates data that are supplied from the SI database 15 and the EPG database 16 and data indicating the transmission statuses of schedule EPG data that indicate program broadcast schedules into packets of a prescribed fixed length and outputs the packets to the transport stream multiplexer 14.

A schedule database 18 supplies a system controller 19 with the contents, transmission rates, re-transmission cycles, etc. of video data, audio data, and EPG data, respectively, that will be transmitted from the information transmitting apparatus at each time point. Based on the data supplied from the schedule database 18, the system controller 19 manages the states of the MPEG video encoders 11-1 and 11-2 and the MPEG audio encoders 12-1 and 12-2 and controls the bit rates of video elementary streams that are output from the MPEG video encoders 11-1 and 11-2 and audio elementary streams that are output from the MPEG audio encoders 12-1 and 12-2. Further, the system controller 19 controls the amount of packets that are output from the SI/EPG

data generator 17. Still further, the system controller 19 controls the multiplexers 13-1 and 13-2 and the transport stream multiplexer 14 to thereby control the video data occupation bandwidth, the audio data occupation bandwidth, and the EPG data occupation bandwidth in relation to the transmission channel bandwidth.

The transport stream multiplexer 14 multiplexes packets that are supplied from the multiplexers 13-1 and 13-2 and the SI/EPG data generator 17 and outputs a transport stream. A modulator 20 modulates a transport stream that is output from the transport stream multiplexer 14 according to a prescribed modulation scheme and outputs a modulated transport stream TS to, for example, an antenna (not shown) in the case of transmission by radio waves or to a prescribed interface in the case of transmission via a cable.

Fig. 4 is a table showing an EIT in which the total transmission rate of EPG information is set at 330 kbps. In the EIT shown in Fig. 4, the re-transmission cycle of program information of other stations that are 6-24 hours away is set at 10 seconds that is 1/2 of that of the EIT shown in Fig. 1. The re-transmission cycle of program information of other stations that are 2-3 days away is set at 20 seconds that is 1/3 of that of the EIT shown in Fig. 1. The re-transmission cycle of program information of other stations that are 4-8 days away is set at 30 seconds that is 1/6 of that of the EIT shown

in Fig. 1. Therefore, the transmission rate of program information of other stations that are 6-24 hours away in the EIT shown in Fig. 4 is set at 64 kbps, which is two times higher than in the EIT shown in Fig. 1. The transmission rate of program information of other stations that are 2-3 days away in the EIT shown in Fig. 4 is set at 60 kbps, which is three times higher than in the EIT shown in Fig. 1. The transmission rate of program information of other stations that are 4-8 days away in the EIT shown in Fig. 4 is set at 120 kbps, which is six times higher than in the EIT of Fig. 1. A wider transmission channel bandwidth is required to transmit EPG data according to the EIT shown in Fig. 4 than to transmit EPG data according to the EIT shown in Fig. 1.

Fig. 5 shows how a video data occupation bandwidth, an audio data occupation bandwidth, and EPG data occupation bandwidth vary with time in relation to a transmission channel bandwidth in a case where EPG data is transmitted according to the EIT of Fig. 4 in periods from time 0:00, 2:00, and 4:00 to prescribed time points and according to the EIT of Fig. 1 in the remaining periods. The EPG data occupation bandwidth is wider in the periods from time 0:00, 2:00, and 4:00 to the prescribed time points than in the remaining periods.

Conversely, the video data occupation bandwidth and the audio data occupation bandwidth are narrower in the periods from time 0:00, 2:00, and 4:00 to the prescribed time points than

in the remaining periods. It is necessary to set the video data bit rate and the audio data bit rate lower in the periods from time 0:00, 2:00, and 4:00 to the prescribed time points than in the remaining periods.

Fig. 6 is a flowchart showing a bandwidth allocation changing process of the system controller 19. At step S11, the system controller 19 reads out, from the schedule database 18, data indicating current allocation of a video data occupation bandwidth, an audio data occupation bandwidth, and an EPG data occupation bandwidth. At step S12, by using the read-out data indicating the bandwidth allocation, the system controller 19 calculates video data transmission rates of the channels corresponding to the MPEG video encoders 11-1 and 11-2, audio data transmission rates of the channels corresponding to the MPEG audio encoders 12-1 and 12-2, and a transmission rate of EPG data.

At step S13, the system controller 19 sets, in each of the MPEG video encoders 11-1 and 11-2, the MPEG audio encoders 12-1 and 12-2, and the SI/EPG data generator 17, a transmission rate of packets that are output therefrom. At step S14, the system controller 19 sets operations corresponding to the allocation of a video data occupation bandwidth, an audio data occupation bandwidth, and an EPG data occupation bandwidth in the multiplexers 13-1 and 13-2 and the transport stream multiplexer 14.

In the above-described manner, the information transmitting apparatus 1 can change the re-transmission cycle of EPG data at prescribed time points based on data that is set in the schedule database 18.

Fig. 7 is a block diagram showing an information receiving apparatus according to an embodiment of the invention. The information receiving apparatus 2 receives a transport stream that is supplied from a predetermined transmission channel and outputs a prescribed video signal and a prescribed audio signal based on a signal corresponding to a manipulation on a remote controller 3.

The remote controller 3 transmits a prescribed infrared signal to an infrared rays (Ir) receiver 39 of the information receiving apparatus 2 based on a manipulation such as a channel selection by the user of the information receiving apparatus 2. The Ir receiver 39 outputs, to a system controller 38, prescribed data corresponding to an infrared signal transmitted from the remote controller 3. The system controller 38 supplies a demultiplexer 32 with PID (packet identification data) that is based on a channel selection manipulation by the user, and supplies an EPG controller 35 with data indicating an operation that is based on a display manipulation by the user. The system controller 38 extracts data that is described in the descriptor of EPG data of current and next programs and indicates the transmission statuses of schedule EPG data that indicate

program broadcast schedules.

A demodulator 31 demodulates a transport stream TS that has been modulated according to a prescribed scheme and supplies a demodulated transport stream to the demultiplexer 32. The demultiplexer 32 divides a transport stream, and supplies a video elementary stream obtained from packets having prescribed PID to a video encoder 33, an audio elementary stream obtained from packets having prescribed PID to an audio decoder 34, EPG data to the EPG controller 35, and SI data to the system controller 38.

The video decoder 33 decodes a received video elementary stream and outputs a video signal according to a prescribed scheme to a display controller 37. The audio decoder 34 decodes a received audio elementary stream and outputs an audio signal to the outside.

The EPG controller 35 stores EPG data that is supplied from the demultiplexer 32 in an EPG memory 36. The EPG controller 35 reads out data stored in the EPG memory 36 under the control of the system controller 38 and outputs the read-out data to the display controller 37 according to a prescribed scheme. The display controller 37 outputs a prescribed video signal to the outside based on signals supplied from the video decoder 33 and the EPG controller 35.

Fig. 8 is a flowchart showing the operation of an EPG data acquisition process of the information receiving apparatus

2. At step S21, the system controller 38 judges whether there has occurred an EPG data acquisition request. If there has occurred an EPG data acquisition request, the process goes to step S22, where it is judged whether the setting of the system controller 38 by the user's manipulating the remote controller 3 is such that EPG data should be acquired only at the time of rate increase (the total transfer rate of EPG information is increased). If it is judged at step S22 that EPG data should be acquired only at the time of rate increase, the process goes to step S23, where the system controller 38 judges whether it has set data of a rate increase period in the EPG controller 35.

If it is judged at step S23 that no data of a rate increase period has been set in the EPG controller 35, the process goes to step S24, where the system controller 38 searches for data of an EPG data rate increase period that is included in SI data supplied from the demultiplexer 32. At step S25, the system controller 38 judges whether data of a rate increase period could be retrieved. If it is judged that data of a rate increase period could be retrieved, the process goes to step S27, where the system controller 38 sets the data of a rate increase period in the EPG controller 35 as data acquisition time. Then, the process goes to step S28.

If it is judged at step S25 that no data of a rate increase period could be retrieved, the system controller 38

sets default data acquisition time in the EPG controller 35. Then, the process goes to step S28.

At step S28, the EPG controller 35 judges whether the present time is the thus-set data acquisition time. If it is judged that the present time is the thus-set data acquisition time, the process goes to step S29, where EPG data is acquired and stored in the EPG memory 36.

If it is judged at step S28 that the present time is not the thus-set data acquisition time, the process is finished.

If it is judged at step S23 that data for a rate increase period has been set in the EPG controller 35, the process goes to step S28.

If it is judged at step S22 that EPG data should be acquired also at time other than the time of rate increase, the process goes to step S29, where EPG data is acquired and stored in the EPG memory 36.

If it is judged at step S21 that there has occurred no EPG data acquisition request, the process is finished.

As described above, the information receiving apparatus 2 can acquire EPG data only in rate increase periods. Periods when the total transmission rate of EPG information should be increased may be determined by management and the information receiving apparatus 2 may be caused to operate in accordance with the management.

Fig. 9 shows an EIT form that defines a description

format of EPG data of current and next programs. A table ID (table_id) on the second line of the EIT to a last table ID (last_table_id) on the 16th line are a header portion to be used for identification of this EIT. An event ID (event_id) on the 18th line and the following items are for description of transmission information relating to the current and next programs, and has a loop structure to allow repetitive description of transmission information relating to a plurality of programs. The transmission information relating to the current and next programs consists of program start hours, program lengths, and other information. Information relating to a program such as a program title or a genre of the program can be described in a descriptor on the 25th line.

Fig. 10 shows a description of the transmission statuses of schedule EPG data that are described in the descriptor of EPG data of current and next programs and indicate program broadcast schedules. To describe the statuses of a plurality of schedule EPG data indicating program broadcast schedules, the second to sixth lines have a loop structure. A table ID (table_id) on the third line indicates an ID corresponding to schedule EPG data indicating a program broadcast schedule. A status flag (status_flag) on the fourth line indicates that the information transmitting apparatus 1 is transmitting schedule EPG data indicating the corresponding program broadcast schedule if it has a value "1," and indicates

that the information transmitting apparatus 1 is not doing so if it has a value "0." A version number (version_number) on the fifth line indicates a value that allows the information receiving apparatus 2 to recognize whether the content is the same as in an already acquired descriptor.

As described above, by reading out the contents of the descriptor of EPG data of current and next programs, the information receiving apparatus 2 can recognize, at the re-transmission cycle of the EPG data of current and next programs, the transmission statuses of schedule EPG data indicating program broadcast schedules.

Fig. 11 is a flowchart showing a process of the information receiving apparatus 2 for acquiring data of the transmission statuses of schedule EPG data indicating program broadcast schedules. At step S11, the system controller 38 reads out the descriptor of EPG data of current and next programs. At step S12, the system controller 38 judges whether the descriptor of the EPG data of current and next programs includes data that indicates the transmission status of schedule EPG data indicating a program broadcast schedule. If it is judged that the descriptor of the EPG data of current and next programs includes data that indicates the transmission status of schedule EPG data indicating a program broadcast schedule, the process goes to step S13, where a table ID and a version number is read out.

At step S14, the system controller 38 judges whether there exists already acquired data relating to the transmission status of schedule EPG data indicating a program broadcast schedule corresponding to the table ID that was read out at step S13. If it is judged that there exists already acquired data relating to the transmission status of schedule EPG data indicating a program broadcast schedule, the process goes to step S15. At step S15, the system controller 38 judges whether the version number has been updated by comparing the version number that is included in the already acquired data relating to the transmission status of schedule EPG data indicating a program broadcast schedule with the version number read out at step S13. If it is judged that the version number has been updated, the process goes to step S16, where the system controller 38 reads out the data of the transmission status of schedule EPG data indicating a program broadcast schedule and stores it in a prescribed register inside the system controller 38.

If it is judged at step S14 that there is no already acquired data relating to the transmission status of schedule EPG data indicating a program broadcast schedule, the process goes to step S16, where the system controller 38 reads out the data of the transmission status of schedule EPG data indicating a program broadcast schedule and stores it in a prescribed register inside the system controller 38.

If it is judged at step S15 that the version number has not been updated yet, the process goes to step S17.

At step S17, the system controller 38 judges whether there exists next data that indicates the transmission status of schedule EPG data indicating a program broadcast schedule. If it is judged that there exists next data that indicates a transmission status of schedule EPG data indicating a program broadcast schedule, the process returns to step S13 to repeat execution of step S13 and the following steps.

If it is judged at step S12 that the descriptor of the EPG data of current and next programs includes no data that indicates a transmission state of schedule EPG data indicating a program broadcast schedule, the process is finished. If it is judged at step S17 that there exists no next data that indicates a transmission state of schedule EPG data indicating a program broadcast schedule, the process is finished.

As described above, the information receiving apparatus 2 can recognize, at the re-transmission cycle of EPG data of current and next programs, the transmission statuses of schedule EPG data indicating latest program broadcast schedules by reading out the contents of the descriptor of the EPG data of current and next programs.

Fig. 12 shows a form of a table information table (TIT) that defines a description format of SI that indicates presence/absence of each piece of table information of an EIT

or the like, a transmission cycle of EPG data, an updating date and time of EPG data, etc. The descriptions from a table ID (table_id) on the second line of the TIT to a last table ID (last_table_id) on the 16th line represent a header portion to be used for identification of this TIT. A table ID (table_id) on the 18th line and the following items describe transmission information relating to an EIT and has a loop structure to enable repetitive description of transmission information relating to a plurality of EITs. The transmission information relating to an EIT consists of a re-transmission cycle of the EIT, last updating time, a transmission status of the EIT, etc.

By utilizing transmission information relating to EITs that is described in SI according to the above TIT description format, the information receiving apparatus 2 can recognize the transmission statuses of schedule EPG data indicating program broadcast schedules by executing a process equivalent to the one shown in Fig. 11.

As described above, the information receiving apparatus 2 can recognize, in a short time, the transmission statuses of schedule EPG data indicating transmission-side program broadcast schedules.

In this specification, the term "system" means the entire apparatus that consists of a plurality of apparatuses.

Not only recording media such as a magnetic disk, a CD-ROM, a solid-state memory but also communication media such

as a network and a satellite can be used as a provider for providing a user with a computer program for execution of the above-described process.

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